Universitat Politècnica de Catalunya
Escola Universitària Politècnica de Vilanova i la Geltrú
Secció d'Anglès

WORKBOOK OF TECHNICAL ENGLISH 2

(E. Telec. / E. Industrial)

Curs 1996-97
1ª Part

Departament de Projectes de l'Enginyeria.
SECCIÓ D'ANGLÈS.

Carmen Rueda Ramos.

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Alphabetical list of irregular verbs

Infinitive	Past tense	Past participle
arise	arose	arisen
awake	awoke	awoken
be	was	been
bear	bore	borne
beat	beat	beaten
become	became	become
begin	began	begun
bend	bent	bent
bet	bet, betted	bet, betted
bid	bade, bid	bid
bind	bound	bound
bite	bit	bitten
bleed	bled	bled
blend	blended; blent	blended
blow	blew	blown
break	broke	broken
breed	bred	bred
bring	brought	brought
broadcast	broadcast	broadcast
build	built	built
burn	burnt, burned	burnt, burned
burst	burst	burst
buy	bought	bought
cast	cast	cast
catch	caught	caught
choose	chose	chosen
cling	clung	clung
clothe	clothed, clad	clothed
come	came	come
cost	cost	cost
creep	crept	crept
cut	cut	cut
dare	dared	dared
deal	dealt	dealt
dig	dug	dug
do	did	done
draw	drew	drawn
dream	dreamt, dreamed	dreamt, dreamed
drink	drank	drunk
drive	drove	driven
dwell	dwelt	dwelt
eat	ate	eaten
fall	fell	fallen
feed	fed	fed
feel	felt	felt
fight	fought	fought
find	found	found
flee	fled	fled
fling	flung	flung
fly	flew	flown
forbid	forbade, forbad	forbidden
forecast	forecast	forecast
forget	forgot	forgotten
forgive	forgave	forgiven
forsake	forsook	forsaken
freeze	froze	frozen
get	got	got
give	gave	given
go	went	gone
grind	ground	ground
grow	grew	grown
hang	hung, hanged	hung, hanged
have	had	had
hear	heard	heard
hide	hid	hidden
hit	hit	hit
hold	held	held
hurt	hurt	hurt
keep	kept	kept
kneel	knelt	knelt
knit	knitted, knit	knitted, knit
know	knew	known
lade	laded	laden
lay	laid	laid
lead	led	led
lean	leant, leaned	leant, leaned
leap	leapt, leaped	leapt, leaped
learn	learnt, learned	learnt, learned
leave	left	left
lend	lent	lent
let	let	let
lie	lay	lain
light	lit	lit
lose	lost	lost
make	made	made
mean	meant	meant
meet	met	met
mistake	mistook	mistaken
mow	mowed	mown
pay	paid	paid
put	put	put
quit	quit	quit
read [ri:d]	read [red]	read [red]
rid	rid	rid
ride	rode	ridden
ring	rang	rung
rise	rose	risen
run	ran	run
saw	sawed	sawn
say	said	said
see	saw	seen
seek	sought	sought
sell	sold	sold
send	sent	sent
set	set	set
sew	sewed	sewn
shake	shook	shaken
shed	shed	shed
shine	shone	shone
shoe	shod	shod
shoot	shot	shot
show	showed	shown

Infinitive	Past tense	Past participle
shrink	shrank, shrunk	shrunk
shut	shut	shut
sing	sang	sung
sink	sank	sunk
sit	sat	sat
sleep	slept	slept
slide	slid	slid
sling	slung	slung
slink	slunk	slunk
slit	slit	slit
smell	smelt, smelled	smelt, smelled
sow	sowed	sown
speak	spoke	spoken
speed	sped, speeded	sped, speeded
spell	spelt, spelled	spelt, spelled
spend	spent	spent
spill	spilt, spilled	spilt, spilled
spin	spun, span	spun
spit	spat	spat
split	split	split
spoil	spoilt, spoiled	spoilt, spoiled
spread	spread	spread
spring	sprang	sprung
stand	stood	stood
steal	stole	stolen
stick	stuck	stuck
sting	stung	stung
stink	stank, stunk	stunk
stride	strode	stridden
strike	struck	struck
string	strung	strung
strive	strove	striven
swear	swore	sworn
sweep	swept	swept
swim	swam	swum
swing	swung	swung
take	took	taken
teach	taught	taught
tear	tore	torn
tell	told	told
think	thought	thought
throw	threw	thrown
thrust	thrust	thrust
tread	trod	trodden
upset	upset	upset
wake	woke	woken
wear	wore	worn
weave	wove	woven
weep	wept	wept
win	won	won
wind	wound	wound
wring	wrung	wrung
write	wrote	written

Key to exercises

TEXT

Exercise 2

Answer B: **The integrated circuit and its advantages.**

Exercise 3

a. T
b. F / The manufacture of a silicon chip is much **cheaper** than that of a transistor.
c. F / Discrete circuits are much **less** reliable than ICs.
d. T
e. F / ICs require **fewer** solder joints and mechanical connections **than** discrete circuits.
f. T

Exercise 4

The three main features which determine a monolithic IC are:

a) Many components are assembled **within a single silicon chip.**
b) An IC functions as **a complete electronic circuit.**
c) Many ICs are fabricated **simultaneously.**

The three main advantages of ICs are:

a) Their small size because thanks to this, complex systems such as computers have reduced their dimensions.
b) Their low cost because many circuits are manufactured simultaneously.
c) Their high reliability because they require fewer solder joints and mechanical connections. (Therefore, they fail less).

TRANSLATION

1) That material is the best electricity conductor although it is also the most expensive.
2) These are some of the semiconductor materials most widely used in spite of their high cost.
3) This is the most common way of representing a circuit diagram. However/Nevertheless, I do not think (that) it is the best.
4) Although the student separated the two metal plates with an insulating material, the device failed while he was studying the electrical resistance of some conductors.
5) Semiconductors are very important materials in Electronics, although new materials will make the Electronics development possible.
6) Both silicon and germanium are semiconductor materials, although silicon is the most widely used semiconductor for ICs.
7) Both resistors and capacitors can have either a fixed or a variable value.
8) I couldn't see the difference between the integrated and the discrete circuits.
9) In the lab, there was neither a transistor nor a transformer.
10) In spite of the fact of not being an Engineering student he knew a lot about Electronics.

UNIT 1.

1. MODALITY AND HEDGING.

1.I **MODALITY.**

Technical writing also uses modal verbs to give extra meaning to the sentences. However, the use of these words is more restricted than in General English. They are most frequently used to indicate: (1) **OBLIGATION**, (2) **PROBABILITY** and (3) **CAPABILITY**.

1.I.1. OBLIGATION.

In technical writing the sense of obligation is more concerned with **the correct way of doing something** than with moral questions. The modals that express obligation may be ranked according to **the degree of choice** that the human subject (implied or stated) has. They are all used in **instructions**.

–	SHOULD	(is recommended / is expected)
	MUST	(is required)
+	SHALL	(is required)

.**SHOULD** is often employed to convey the idea of *Expectation*, as a substitute for the phrase "it can be expected that". It is also used to convey the idea of recommendation and suggestion. It is less compulsive than MUST.

e.g. (Expectation) The use of high-octane fuel in internal combustion engines should result in improved performance.

e.g. (Recommendation) You should wear gloves when dealing with dangerous substances.

.**MUST** conveys the idea of *Strong obligation*. It is less formal than SHALL.

e.g. (Strong obligation) The mains switch must be turned off in case of fire.

e.g. All dangerous materials near the fire must be removed.

.**SHALL** is used by convention in building codes and design *specifications*. It indicates that the instructions must be followed *exactly*.

e.g. The condensers shall be adequately sized to operate satisfactorily from 50 F to 110 F ambient temperature.

EXERCISES.

1) Decide what the following modals of obligation exactly mean and rewrite the sentences by using a passive verb as in the example given below.

e.g. A long playing record recorded at 33 1/2 rpm must be played at 33 1/2 rpm.

A long playing record recorded at 33 1/2 rpm is required to be played at 33 1/2 rpm.

1.- Earth stations must be capable of detecting very low level signals.

2.- Cassette tapes should not be exposed to direct sunlight.

3.- In spite of the plastic cover, the wires must be properly separated.

4.- If you notice hiss and / or loss of high frequency, the residual magnetism built up on the heads should be removed.

5.- The ventilation of the holes must be unobstructed for the proper operation of the unit.

6.- A different method shall be employed in preparing the edges for welding.

7.- The students that have worked so hard should pass the exam easily.

8.- The cylinder head must be removed when it is hot.

9.- A machine that has been tested several times should work properly.

10.- Scientists should apply logical thought when analysing data.

11.- The greatest care must be exercised to eliminate errors.

12.- The recording of data should be carefully checked when carrying out an experiment.

2) Keeping in mind that SHOULD is used in written meanings and instructions, list several things a student should do and several things a student should not do:

1.- in an electronic laboratory.

2.- when working with electricity.

This is an example of the things a technical writer must do.

"Technical writers are expected to think technically creatively and objectively. They must know the audience they are writing to. They must take the responsibility for reorganizing pertinent material into a good package. Non-pertinent items must be omitted. Technical data must always be accurate.

The reader is interested in information. The writer must get his information across to the reader technically. Technical mistakes can be serious and should be avoided. Short articles are best."

3) Rewrite this passage, using SHOULD with passive forms instead of the imperative form.

> "Fill a test-tube half full of water and heat it nearly to boiling point. Support the tube on a stand and allow it to cool. Take the temperature every minute. Stir carefully with a glass rod. Record the readings you obtain, and plot them on a graph of temperature against time. Repeat this with a tube half-full of crystals. Allow the solid to melt. Heat the liquid to 100 C, fix the tube on the stand and allow it to cool. Record the results as before and plot them."

1.I.2. PROBABILITY.

Probability expresses the **degree of certainty** that something is correct. The modals that indicate probability may be ranked from **relative certainty to remote probability.** They frequently occur in *conclusions* and *abstracts* where the implications of the results obtained are discussed.

Relative certainty	+	MUST	(80 - 98 %)
		SHOULD	(40 - 70 %)
		MAY	(20 - 40 %)
Remote probability	-	MIGHT / COULD	(5 - 20 %)

The use of MUST shows a relative certainty as a result of logical deduction.

e.g. If you switch the light on and you get no light, then the fuse _must_ have blown.

EXERCISES.

1) Fill in the blanks with the appropriate modal of probability according to the relative certainty or remote probability shown above. The sentence can be either active or passive.

1.- A station with a weak signal ________________________ (not receive). (20-40 %).

2.- A non-directional transmitting antenna ______________ __________ (use) with a public broadcast transmitter. (5-20 %).

3.- These particles ___________________ (serve) as the starting point for our experiment. (40-70 %).

4.- Fostering cooperation between states _______________ (be) the most effective way of developing regional communications. (40-70 %).

5.- Some observers _________________ (say) that the idea of implementing fibre optic cabling in rural areas is a ridiculous goal. (5-20 %).

6.- For a rural telephone network to be set up, exchanges _________________ (be) compatible with existing equipment. (80-98 %).

7.- Loose connections __________________ (cause) hum and noise. (20-40 %).

2) Bearing in mind what you have learnt about Obligation and Probability, fill in the blanks according to the information given in brackets.

"A scientific researcher (*probability 20-40 %*)______________ commit some mistakes. For example, he (*remote probability 5-20 %*)______________ fail to read all the relevant literature about the problem he is investigating, and so (*remote probability 5-20 %*)______________________ miss essential pieces of evidence. Or, in designing an experiment or set of experiments, he (*possibility 20-40 %*)__________________ even incorporate the answer he expects or subsconsciously desires. This can easily happen, especially in the fields of psychology or sociology where the questionnaire method is extensively used; the investigator (*probability 80-98%*) ______________ be extremely careful, in framing the questions, to avoid influencing the replies of the subjects who will answer them. To understand and to avoid these errors, the student (*obligation, recommended*)______________ read the detailed accounts of the major scientific discoveries of the past, and wherever it is possible he (*obligation, recommended*)_________________ try to find out the true stories of the development of pieces of modern research. If this procedure is followed, he (*expectation*) ______________ greatly increase his chances of becoming a successful worker himself."

1.I.3. CAPABILITY.

Capability expresses the **degree of ability** that something or somebody has. The modals that show capability are ranked from **strong capability to weak capability.**

Strong capability	+	CAN	(80 - 98 %)
		COULD	(40 - 70 %)
		MAY	(20 - 40 %)
Weak capability	-	MIGHT	(5 - 20 %)

EXERCISES.

1) Complete the passage below putting the appropriate modal verbs in the spaces in accordance with the ideas given in brackets.

"In planning a series of experiments, the scientific worker *(obligation, recommended)*________________________ be aware of the general nature of the problem under investigation as well as of data from other areas of research which *(probability 20-40 %)*____________________ be related to it. Although in a few cases it *(probability 20-40 %)*_________________ be possible to begin with a completely organized theory, it *(obligation, recommended)*_____________________ be kept in mind that even an imperfect theory *(capability 80-98 %)*________________ be very useful, because it *(probability 20-40 %)*__________________ provide a framework which *(capability 40-70 %)*__________________ later be adjusted to fit the results of the experiments. These preliminary hypotheses *(obligation, recommended)*______ ____________ be in accordance with the known facts, and this implies that the researcher *(stong obligation)*_______________ also know the theoretical background of the problem. After he has analysed the problem he *(strong obligation)*_______________ present it in a form as simple as possible, because most pieces of work *(capability 80-98 %)*____________________ be broken up into component parts which *(capability 5-20%)*________________ be dealt with separately. This procedure *(probability 20-40 %)*_____________ help to solve the problem more efficiently."

1.II HEDGING.

When reporting the results of their research, technical writers must state clearly whether their results are proven facts or probable facts. They do this by means of hedging, the degree of the truth of a statement. Hedging is conveyed by means of: (1) **MODAL AUXILIARIES THAT INDICATE PROBABILITY** or (2) **A STATEMENT OF PROBABILITY WITH A SUBORDINATE CLAUSE.**

1.II.1. MODAL AUXILIARIES THAT INDICATE PROBABILITY.

The modal auxiliaries that indicate probability mean the same as the following statements of probability:

Modals of Prob.	*Statements of Prob.*	
MUST	IS CERTAIN TO	80 - 98 %
SHOULD	IS LIKELY TO	40 - 70 %
MAY	IS PERHAPS	20 - 40 %
MIGHT / COULD	IS POSSIBLY IS POSSIBLE TO	5 - 20 %

EXERCISE.

1) Rewrite the following sentences and change the modals of probability by statements of probability as in the example given.

e.g. The machine must have broken down.
The machine is certain to have broken down.

1.- The fuses must have blown.

2.- The fault might be due to a flat battery.

3.- Inadequate sampling could result in invalid data.

4.- Television reception may be affected by "ghosts" due to / or by waves reflected from tall buildings or hills.

5.- Without electricity the whole way of life in industrial countries would change completely and modern civilization should take a totally new form.

6.- Nuclear power may be a solution to the problem of oil supplies but many scientists are not very sure of it.

7.- Lasers on 2-in wafer might be integrated onto opto-electric chips that carry data using both light and current.

1.II.2. STATEMENTS OF PROBABILITY WITH SUBORDINATE CLAUSES.

Another way of expressing hedging is by means of a THAT-clause.

Fact

Intelligent life exists elsewhere in the universe.

Hedge

There is a	high probability	that intelligent life exists in the universe.
	good probability	
	slight probability	
	remote probability	

It is	highly probable	that intel. life exists in the univ.
	quite possible	
	remotely probable	

EXERCISE:

Turn these facts into statements of probability by means of hedging:

1) Governments know the existence of U.F.O.'s

2) People will be able to live in other planets in our Galaxy.

3) In a few years' time we will use visual display telecommunication services for domestic use.

4) By the year 2000 many people will be working at home with computers that are connected to their offices.

5) A new elementary particle smaller than a molecule can be found.

6) The use of computers in modern automobiles makes driving safer and faster.

7) A spaceship can travel in time if it enters a black hole.

UNIT 2.

2. DEFINITIONS

We can define a term or concept by means of a formula (class and characteristics), by means of synonyms and short phrases, or by means of examples.

Traditionally, definitions in technical writing have been divided into two main groups: *simple definition* and *expanded definition*.Within the category of *simple definition* we can single out the following: formal definition, semi-formal definition, and informal (also called non-formal) definition.

2.I TYPES OF DEFINITIONS:

SIMPLE DEFINITIONS.

-formal definitions: They contain a *concept*, *a class* and a relative clause with the *characteristics*. For example:

Concept	Class	Characteristics
dynamics	branch of mathematics	that is concerned with moving bodies
aluminium	a metal	which is produced from bauxite

-semi-formal definitions: this type only contains *concept* and *characteristics*, the class being left out. For example:

"A microscope gives a magnified image of an object"

-informal definitions: the shortest way of definition is using a synonym, rephrasing the term with dashes, commas or parentheses, using expressions such as "that is", "called a" or "namely", or giving examples of it. For example:

"Nukes (short form for nuclear plants) are places where..." : rephrasing within parentheses.

"Low-carbon steel items include bolts, automobile bodies, nails, pipes" : some examples to illustrate the meaning.

EXPANDED DEFINITION

To expand a simple definition, the writer can use a wide range of techniques to help the reader's comprehension. A simple definition be expanded:

.by listing its characteristics or properties, or by categorizing its parts (with "such as", with the verbs "consist of","contain").

.by comparing or contrasting the new term to another one.

.by using visual display.

2.II RELATIVE CLAUSES IN DEFINITIONS.

They give information about a noun or a pronoun. They have the following pattern:

		RELATIVE PRONOUN		
NOUN / PRONOUN DESCRIBED	+	*whom(m)* *which* *whose* *that*	*or Ø*	*+ (Subj) + VERB* *+ Complement*
		CHARACTERISTICS		

2.III RELATIVE PRONOUNS AND RELATIVE CLAUSES WHEN DEFINING

Examples of definitions:

A civil engineer	is a man	**who**	designs public works.
Copper	is a metal	**which**	conducts electricity well.
Brass	is an alloy	**which**	contains large proportion of Cu.
A lab	is a place	**where**	experiments can be made.
An insulator	is a material	**through which**	electricity cannot flow.
A screen	is a surface	**on which**	images are projected.
Venus	is a plane	**whose**	surface temperature is thought to be at least 200º C.

EXERCISES.

1) Re-build these mixed-up definitions:

A dynamo	an animal	.... is used for cutting things.
Gravity	a place	.... consists of only one cell.
A shop	an instrument	..... measures temperature.
A thermometer	a force	.... generates current.
A biologist	a machine	.... attracts bodies towards the centre of the Earth.
A knife	a person	.... things are bought and sold.
An amoeba	an instrument	..... studies living organisms.
Tungsten	a metal	.... retains hardness at red heat.
Stainless steel	an alloy	.... resists corrosion.

3) Write formal definitions of:

-rust

-an engine / a test-tube

-an electromagnetic wave

-a computer

-an engineer

-a diesel engine

-a screwdriver

-viruses

-a valve

-a diskette

-a printer

-a parabolical antenna

4) Complete these definitions:

-A calculator is a device with which

-A filter is a device through which

-A coal mine is an excavation from which

-A transformer is a device by means of which

-An intelligent house is a building whose

-Television was an invention that

-Engineers are people that

-A satellite transmitter is a machine which

2.IV RELATIVE CLAUSES HEADED BY PREPOSITIONS

Look at this:

a) Laboratories are rooms. Experiments are conducted in them.
--Laboratories are rooms *IN WHICH* experiments are conducted (formal)

or:
--Laboratories are rooms *WHICH* experiments are conducted *IN* (informal)
or:
--Laboratories are rooms *WHERE* experiments are conducted.

b) This is the overhead projector. Professor Higgs works with it.
--This is the overhead projector *WITH WHICH* professor H. works.

or:
--This is the overhead projector *WHICH* professor H. works *WITH*.

c) Einstein is the scientist. He writes about him in his book.
--Einstein is the scientist *ABOUT WHOM* he writes in his book.

or:
--Einstein is the scientist *WHO* he writes *ABOUT* in his book.

d) ETSEIB is the school. The lifts of this school do not often work.
--ETSEIB is the school *WHOSE* lifts do not work.

e) A telescope is an instrument. Distant objects are made to appear larger by means of a telescope.

--A telescope is an instrument *BY MEANS OF WHICH* distant objects are made to appear larger.

f) Electroplating is the process. A thin layer of metal is bonded to another metal by the process.

--The process *BY WHICH* a thin layer of metal is bonded to another metal is electroplating. *(Notice the use of the PASSIVE VOICE in this case)*

EXERCISES.

5) Join these pairs of sentences using active relative clauses. Use the formal and informal style when you can.

1.- A plane seats 300 passengers. It is already in service.

2.- A hydro-electric power station produces 4 1/2 million KW. It is in operation at Bratsk in Russia.

3.- The subject is wear corrosion. This report is concerned with the subject.

4.- The budgetary report referred to the article. The article was no longer available.

5.- Students do not check their calculations. They often make mistakes.

6.- Some of the tankers will have a displacement of nearly half a million tons. Japanese companies are now building them.

7.- Are those the colleagues? Do you work with them?

8.- Stufflebeam is the physician. His theories are discussed everywhere.

9.- The researchers relied on the data. The data turned out to be inaccurate.

10.- This is the drawing-table. I left my compass on it.

6) In these sentences one of the choices is *right*. Cross out the wrong wh-clauses:

1.- The glass **which/ from which/ by which** X are made must be fire-proof.

2.- A rectifier is a device **which/ by which/ in which** allows an electric current to flow in only one direction.

3.- There are several ways **for which/ in which/ of which** sunshine can be controlled to provide heat.

4.- A container of hot water gives out heat to the objects **which/ by which/ in which** it is surrounded.

5.- Effort and load are forces **whom/ through which/ which** can be measured.

6.- Accoustics is a branch of physics **in which/ which/ for which** the properties of sounds are studied.

7.- A drill is an instrument **on which/ round which/ with which** holes are made.

8.- A proton is a positive particle **which/ by which/ of which** forms part of the nucleus of an atom.

9.- The process **for which/ by which/ in which** plants build up glucose is called photosynthesis.

10.- A turbine is an engine **round which/ in which/ by which** blades are forced to rotate.

2.V REDUCED RELATIVE CLAUSES

Both active and passive relative clauses can be made more concise through reduction. This reduction or shortening is very common in scientific writing. However, reduction is usually a choice, not a requirement. In the reduced clause ***both the WH-word and BE are omitted.*** Here are two examples:

e.g. Bicycles *which are* left in the rain become rusty.
--Bicycles ***left*** in the rain become rusty.
(past participle)

e.g. The weather system *which is approaching the coast* is a hurricane.
--The weather system ***approaching*** *the coast* is a hurricane
(present participle)

EXERCISES.

7) Join (or just reduce) these pairs of sentences using reduced relative clauses where you can:

1.- The plutonium which was stolen from the lab was never found.

2.- Metal is covered with paint or plastic. Metal is more resistant to corrosion.

3.- The town was rebuilt in two years. The hurricane destroyed the town.

4.- An exercise is written in a hurry. It may contain silly mistakes.

5.- Scientists who are studying volcanoes know that small earthquakes usually precede eruptions.

6.- The plan was prepared by the U.N. It was accepted by the government.

7.- The curve which is shown presents the final results.

8.- The new bottling machine was ordered by the firm. It cost $ 1,300,500 .

9.- The computer has been "down" (not working) for two weeks. The EECS department installed the computer.

10.- A dam requires less concrete but more labour. A dam is used in rocky mountain areas.

11.- People who are living near airports often suffer from heart problems which are caused by noise pollution.

12.- The person who will have the answer to this program is the project manager.

* However, **you will have noticed that not** all passive relative clauses can be reduced. Firstly, there are no reduced forms of relative clauses beginning with a preposition:

The material from which this beam is made must be fire-proof
--"the material from this beam is made must be fire-proof"
WRONG!

* Secondly, there are normally no reduced forms of clauses containing modal verbs:

Here is a list of experiments which *should* be done this year.
--"Here is a list of experiments *done* this year" *is CORRECT*

but it has another meaning, because the extra meaning of the modal verb has been lost.

8) Replace the expression in italics with an appropriate -ing form. You may have to change nouns into verbs. In this exercise there are two kinds of -ING form:

-Reduced relative clause
-a noun that becomes a verb preceded by a prep.:
"through the application---->through applying"

1.- The force *that links* atoms together to form molecules is called the chemical bond.

2.- Technologists are concerned with *the application of* pure science to practical affairs.

3.- Air-speeds *that exceed* several times the speed of sound have been reached by modern types of aircraft in level flight.

4.- A good investigator is interested in *the explanation of* the phenomena around him.

5.- Engineers in many parts of the world are engaged in *the development of* machines capable of exerting extreme pressures on materials.

6.- Bodies in space *that revolve* around larger bodies are called satellites.

7.- The blood *that circulates* in our veins and arteries is a mixture of several substances.

8.- A type of radiation *which consists* of light and sub-atomic particles is released by radioactive elements.

9.- The efficiency of a power supply system can be calculated by *a measurement of* the difference between the potential intake (input) of energy and the actual output.

10.- Experiments *which proved* the effects of air pressure were conducted by Torricelli and Pascal.

11.- Numbers *that consist* of digits are called integers.

12.- Statistics is a discipline *which affects* all the other sciences.

13.- A person *who does* research in chemistry is called a research chemist.

2.VI RELATIVE CLAUSES WHERE THE RELATIVE CAN BE OMITTED.

We may omit the relative pronoun (which, that, whom) if it is the **object of a verb or preposition.**
Example:

e.g. A worker may not be in the same room with the dangerous material
| *Ø he is working on.* |
| *which he is working on.* |
| *on which he is working.* |

However, if the relative pronoun is the *subject* of the relative clause, then we cannot omit the relative pronoun.

e.g. The scientist that / who wrote this article is Swiss.
cannot be omitted

e.g. The article (that / which) he wrote is good.
can be omitted

EXERCISES.

9) Rewrite the following sentences omitting the relatives if possible.

1.- This is the badge which we carry to show the amount of radiation.

2.- The radioisotopes that are prepared in this way are exported.

3.- The rooms where it is handled in are separated from others by lead doors.

4.- The Geiger counter makes sounds which we can easily hear.

5.- These are instruments that transmit the motions of his hands.

6.- This is the hardest problem that I have ever seen.

7.- Hydrogen is one of the lightest gases that we know.

8.- Iron is the most useful metal that exists.

9.- Bronze was one of the earliest alloys that man made.

10.- Smelting is not easy, but it is not the most difficult operation that is known.

11.- He is the man who developed that theory.

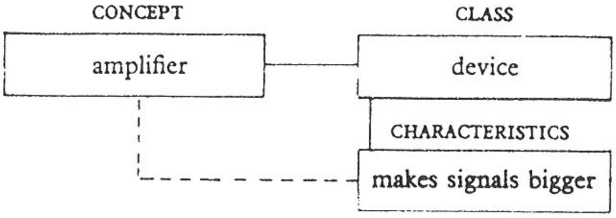
12.- That is the system which we used last year.

13.- This is the part of the engine that broke down.

10) A friend of yours lets you know that he has decided to study engineering and he wants to know what engineering studies consist of. He asks you, a "veteran" in the school, to explain. First of all, as you want him to know what engineering is, give him a brief but sufficiently clear definition of it. Make use of as many techniques found in definitions as possible. Then, you could tell him about the syllabus (subject matters, specialities, and so on).

2.VII TYPES OF DEFINITIONS.

- *Simple definitions*.



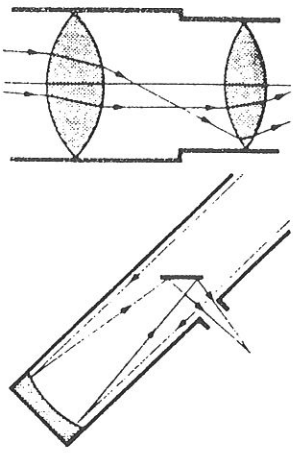
e.g. An amplifier is a device that makes signals bigger.
A frequency changer is a machine designed to receive power at one frequency and deliver it at another frequency.

- *Expanded definitions*. It is a simple definition which can be expanded by:

a) listing characteristics or properties or by explaining its composition;
b) by comparing the new term to one already familiar to th reader;
c) by using visual information.

Now look at this example:

A telescope is an instrument for magnifying distant objects. It has two essential parts: the **objective** which collects light from the distant object and forms a real image, and the **eye-piece** which forms a magnified image of this image. Refracting telescopes use a convex lens as the objective and reflecting telescopes use a curved mirror of large diameter.



Which of the following pieces of information does the paragraph include?

a function of telescopes
b main structure of telescopes
c invention of the telescope
d function of the main parts of a telescope
e some types of telescopes
f different uses of the types of telescopes

1) Study the following definitions concerned with chemistry and underline the part of each definition that refers to the characteristics.

1.- Elements are chemical substances that cannot be broken down into anything simpler by chemical means.

2.- A neutron is a particle having the same mass as a proton but carrying no electrical charge.

3.- A trace is a substance used to follow a chemical reaction or a physical process.

4.- Fractional distillation is the distillation process in which liquid mixtures are separated into their components.

5.- A catalyst is a substance which accelerates a chemical reaction.

6.- Cracking is the process by which large molecules are broken down into smaller ones by means of high temperatures and pressures.

Note that in the above statements the characteristics and the class are connected by means of certain relative words:

CLASS — CHARACTERISTICS

that …
which …
in which …
having … used for

2.VIII EXPRESSION USED IN DEFINITIONS.

a)

concept	*is defined as* *may be defined as*	class + characteristics

b)

class + characteristics	*is known as* *is called*	name of concept

Example of the first type:

"*Chemistry* | is defined as / is | the branch of physical science which studies the composition, properties and reactions of substances"

Example of the second type:

"The branch of physical science that studies the composition, properties and reaction of substances
| is known as / is called | *Chemistry*".

2) Fill in the blanks using: *that controls, used in, designed to, which, can be defined as.* The definitions all concern electronics.

1.- A wafer is a piece of semiconductor____________________ transistors.

2.- White noise __________________________ acoustic waves contaning a wide range of adjacent random frequencies.

3.- A parasitic aerial is an aerial _________________is not fed directly but which gains its energy by being close to a driven aerial.

4.- Automatic frequency control (AFC) is a feedback circuit ____________________ the average radio frequency of an FM receiver.

5.- A resistor is an electric component ____________________ introduce known resistance into a circuit.

TELEVISION.

Television is a telecommunication system in which both visual and aural information is transmitted for reproduction at a receiver. The basic elements of the system are:

- *television cameras and microphones* that convert the original visual and aural information into electrical signals, i.e. into video signals and audio signal respectively;
- *amplifiers* and control and transmission circuits that transmit the information along a suitable communication channel: broadcast television uses a modulated radiofrequency carrier wave;
- *a television receiver* that detects the signals and produces an image on the screen of a specially designed cathode-ray tube and a simultaneous sound output from a loudspeaker.

The information on the target in the television camera tube is extracted by scanning and the spot on the screen of the receiver tube is scanned in synchronism with it to produce the final image. A process of rectilinear scanning is used in which the electron beam traverses the target area in both the horizontal and vertical directions. The horizontal direction is called the line and the vertical direction is known as the field. Sawtooth waveforms are used to produce the deflections of the beam, and in both the camera and receiver the flyback period is blanked out.

European television systems use a 50 Hz field frequency system with 625 lines per frame. American television uses a 60 Hz field frequency and 525 lines per frame.

Definition in television is a measure of the resolution of the system, which in turn depends on the number of lines per frame. High-definition systems have more lines. Some closed-circuit television systems may use even 2000 lines per frame.

The basic television system transmits images in black and white only (monochrome television). Colour television is now widely used and the broadcast signal is received on special colour receivers. Modern monochrome receivers use the brightness information transmitted as part of the colour signal --the luminance signal-- but the image produced is black and white.

The transmitted signal contains both video and audio information. The picture carrier is the carrier wave modulated by the video information. The audio signal modulates a second carrier wave, known as the sound carrier. The sound-carrier frequency differs from that of the picture carrier and is chosen so that both signals fall within a designated radio frequency band but do not overlap each other.

1.- How many definitions can you find in the text?

2.- What is the function of a television camera? and of a television microphone?

3.- What does "deflection" on line 20 mean?
a) movement b) shape c) inclination d) angle

4.- Which has higher definition, European or American TV?

5.- Give a definition of "monochrome".

6.- What is the relationship between sound-carrier and picture carrier frequencies?

3) Read this text carefully. Identify the different kinds of relative clauses and and answer the questions below.

METALS AND ORES.

Man learnt to make fires and later to construct furnaces hot enough to liquify most of the metals he used, and he discovered that the molten metal could be poured into cavities in stone or clay and allowed to become solid, assuming the shape of the mould. Archaeologists have discovered many ancient weapons, made by casting in this manner.

The art of mixing metals was gradually developed and it became known that an "alloy" formed in this way was sometimes stronger, harder and tougher than the metals of which it was composed. Probably the first alloy to be made was a bronze consisting of copper with about one part in ten of tin. There is evidence that the early workers understood that if higher contents of tin were used the alloy was harder, while less tin gave a softer alloy, so that for different purposes bronzes with varying tin contents were deliberately produced.

Gold and, to a lesser extent, silver, were regarded as "noble metals" because they could be exposed to the atmosphere for a long time without tarnishing, and because they could be melted repeatedly without much loss in weight. These characteristics led people to use them for jewellery and coinage. The possession of noble metals consequently became a measure of wealth, so that gold and silver were wanted for their value as well as for their usefulness. All the other metals known then, such as tin, lead, copper and iron, were considered "base metals".

It was perhaps natural to imagine that one metal could be changed into another, and it seemed particularly desirable that base metals could be changed into noble ones --specially gold. The art of Alchemy began in the Middle East and prospered in that part of the world and in Europe till the end of the seventeenth century. Alchemists searched for the Philosophers' Stone, which was supposed to be capable of turning base metals into gold or silver.

While the alchemists were trying all kinds of experiments to produce the Philosophers' Stone, the metal workers, though using fewer words of magic, were continuing to get more solid results in a wonderful process: the changing of dull, earthy minerals (ores) into metals by smelting them with charcoal in a fire or furnace. They learnt how to recognize those metallic ores which could profitably be smelted, and how to apply the necessary operations to transform them into metal. It is not surprising that their efforts were sometimes unssuccessful. Even today producers of metal meet difficulties because of the impurities of the ore. These upset smelting operations or have a harmful influence on the rsulting metal. In those early days such happenings were thought to be the results of the Evil Eye, or the attentions of kobolds[1] or Old Nick[2] himself. The names of the two metals, cobalt and nickel, were taken from the names of these two evil spirits.

1.- How can metals be liquified?

2.- Molten metals are sometimes poured into moulds. What are these moulds made of?

3.- What metals are used for making bronze?

4.- Why was the proportion of tin in bronze deliberately changed?

5.- What were the noble metals? Why were they considered "noble"?

6.- What did the alchemists try to find, and why did they do so?

7.- What did the metal workers need charcoal for?

8.- How were early failures in smelting explained?

---

[1] Kobold: A German spirit which was supposed to come into houses.

[2] Old Nick: The devil.

UNIT 3.

3. DESCRIBING FUNCTION & PURPOSE.

This unit is closely related to the previous one, since describing the function & purpose of an instrument, together with its parts, is also a way of giving a definition of it. In this unit different structures and expressions used to convey the idea of operation and composition as well as the purpose of an object are studied. This function is most frequently used in **manuals** where there is an *explanation of how something works* and a *description of its components*.

3.I PURPOSE.

-Some expressions showing purpose:

·***The function of..... is to....***

ex: The function of the tripod is to support the apparatus.

·***X is used for......***

ex: The tripod is used for supporting the apparatus.

FOR is used before the -ing form of a verb to express the purpose of an object (i.e. "What it is used for").
ex: An altimeter *is used for measuring* height above sea-level.

But you can also use the infinitive of purpose (**TO+ V**) and say
An altimeter is used *to measure* height above sea-level.

-**THE INFINITIVE OF PURPOSE (TO+V)** can also be substituted by the expressions **in order to / so as to.** These two expressions are used in a very formal context and they may appear at the beginning of the sentence.

"The scientist checked all his data ***to find*** the fault in the experiment."

ex: The scientist checked all his data ***in order to / so as to*** find the fault in the experiment.

ex: ***In order to / So as to*** find the fault, the scientist checked all his data.

-Other verbs indicating purpose:

- ***to avoid*** + V-ing

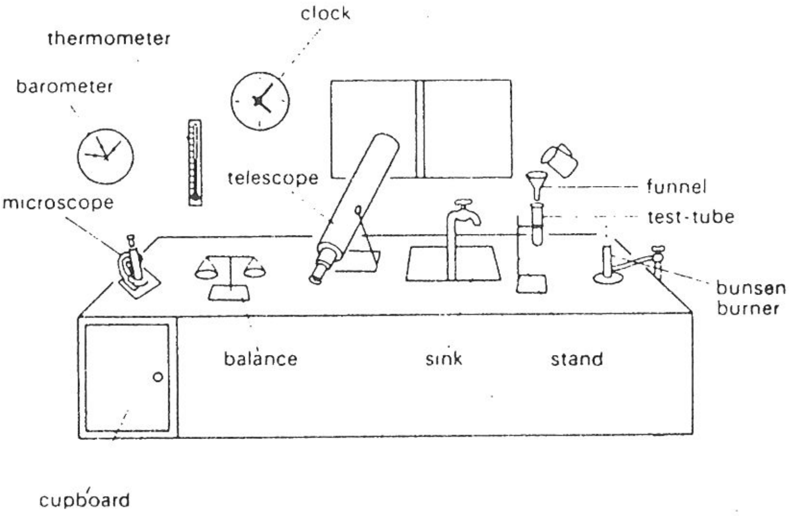
  ex: The scientist checked all his data ***to avoid making*** mistakes.

- ***to prevent*** (Object) ***from*** + V-ing

  ex: The wire has to be covered with plastic *to prevent from (receiving)* an electric current.

EXERCISES:

1.- Look at the picture and complete these sentences.



1) ____________an instrument for measuring temperature.

2) The function of a________________ look at distant objects.

3) The__________ is a place used for (wash)_________ things.

4) The function of the___________________________ supply heat.

5) ____________a device for holding chemicals during experiments.

6) The__________ is a place for (store)____________things.

7) ____________an instrument for looking at very small things.

8) The__________ is a device for (pour)____________liquids.

9) The function of the____________________measure atmospheric pressure.

10) ____________a device for (support)_____________things during experiments.

2) Look at these examples:

"A fan is often installed	*to avoid*	*excessive air pressure".*
	to prevent from	
	in order to avoid	
	so as to avoid	

Now complete these sentences using one of these patterns:

1.- A humidifier is used______________________________
____.

2.- A thermostat is used______________________________
____.

3.- Air-conditioning is desirable in hot climates________
____.

4.- Central heating systems are desirable in cold climates____
____.

5.- Food must be refrigerated__________________________
____.

6.- Engines need lubricating oil_______________________
____.

7.- Car bodies must have several coats of paint__________
____.

3.II DESCRIBING FUNCTION.

In describing how something works we refer to:

a) *COMPOSITION*--> A system consists of a number of parts

ex: Electronic watches *consist of* a quartz crystal, an integrated circuit and a battery.

b) *FUNCTION*--> The parts of a system have different functions which make possible the operation of the whole system.

ex: The battery *provides* an electric current.
ex: The quartz crystal *controls* a tiny motor that moves the hands.

3.II.1 EXPRESSING COMPOSITION.

Many objects can be described in terms of **the relation of their various parts to the whole thing.** There are different ways of expressing this relation:

a) When **the whole thing** is the subject of the sentence, the following expressions are used:

*CONSIST OF
*CONTAIN
*BE DIVIDED INTO
*BE MADE UP OF
*BE COMPOSED OF
*COMPRISE

ex: The communications equipment for a computer system usually *is composed of* cables or phone lines, modems, and controllers.

b) When **the parts** of the whole thing are the subject of the sentence, these expressions are used:

*MAKE UP
*FORM
*CONSTITUTE
*COMPRISE
*BE PART(S) OF

ex: Hardware, software and personnel *made up* the typical computer system of twenty years ago.

EXERCISES:

1.- Read the text carefully, identify the expressions that indicate composition and make a detailed diagram showing the different components of a computer system.

THE COMPONENTS OF COMPUTER SYSTEMS.

Today large computer systems usually have four major parts or components. These are hardware, software, personnel, and communications. The hardware of the system consists of the electronic machines for data input, processing, and output. Software is made up of the various sets of instructions (programs). These programs are used to process the data, control the movement of data into and out of the computer, and develop further sets of instructions.

The personnel in the system is composed of various groups. One group, the data processing or information systems group, operates the computer system and tries to improve it. This group consists of computer operators, programmers, systems analysts, and their managers. Another important group, the users, does such activities as putting data into the computer system, reading the reports made by the system, and asking for changes and additions to it. This group usually includes such people as clerks, sales-people, and managers.

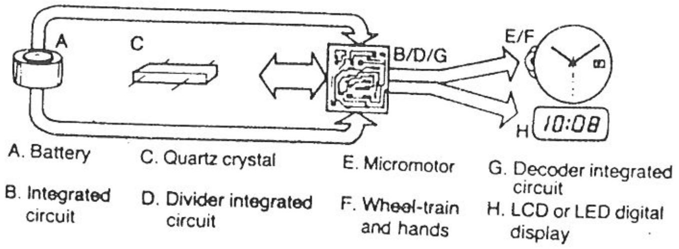
The last element of a modern large system is communications. In a large modern system, the users and the machinery of the system are often spread out over a large area. For example, a sales clerk at a department store might register a sale on a point-of-sale terminal. That sale would be immediately sent to the department store's main computer somewhere else in the city over telephone lines. Various kinds of communications equipment connect the machinery and the users together into a well-organized computer system. This equipment is usually made up of three parts: cables or lines, modems, and controllers. Coaxial cables or telephone lines carry the data. Modems (MOdulators/DEModulators) translate telephone signals into computer signals, and vice versa. Communication controllers control the sending and receiving of data.

Twenty years ago computer systems consisted of only the first three elements: hardware, software, and personnel. Since that time, however, new kinds of systems, which require communication equipment as well as the other three components, have been developed. This change has occurred for two reasons. First, the computer hardware has become more powerful and hence can support more users at one time. Second, software for controlling the input and output of data for many users has been developed.

2) Read the text carefully and answer the questions below:

ELECTRONIC WATCHES.

Electronic watches are based on the technology used in small calculators. They consist esentially of a quartz crystal and a tiny integrated circuit.



An electronic current from a battery makes the quartz crystal vibrate. The integrated circuit contains hundreds of electronic components. It turns the vibrations into a pulse for every second. Then it stores the seconds to make minutes, hours and days.

Electronic watches have three ways of showing the time. Some watches have LEDs (light-emitting diodes) which appear as small red figures. These figures light up only when a button is pressed. Other watches have an LCD (liquid crystal display) which is continuously on.

Other electronic watches have ordinary watch faces and hands. The quartz crystal controls a tiny motor that moves the hands. These watches are called analogue watches.

1.- What are the two main parts of electronic watches?

2.- What are the two main functions of the integrated circuit?

3.- Why is an electric current necessary?

4.- What is the purpose of the button in LED watches?

5.- Why is this kind of button not necessary on LCD watches?

6.- How are the hands of an analogue watch made to move?

3.II.2 EXPRESSING FUNCTION.

The parts of a whole usually have a use or function. The following expressions are used to indicate the function of a system or part:

*SERVE TO
*BE RESPONSIBLE FOR + (Gerund)
*PERFORM THE FUNCTION OF + (Gerund)
*ENABLE
*CONTROL
*REGULATE
*OPERATE

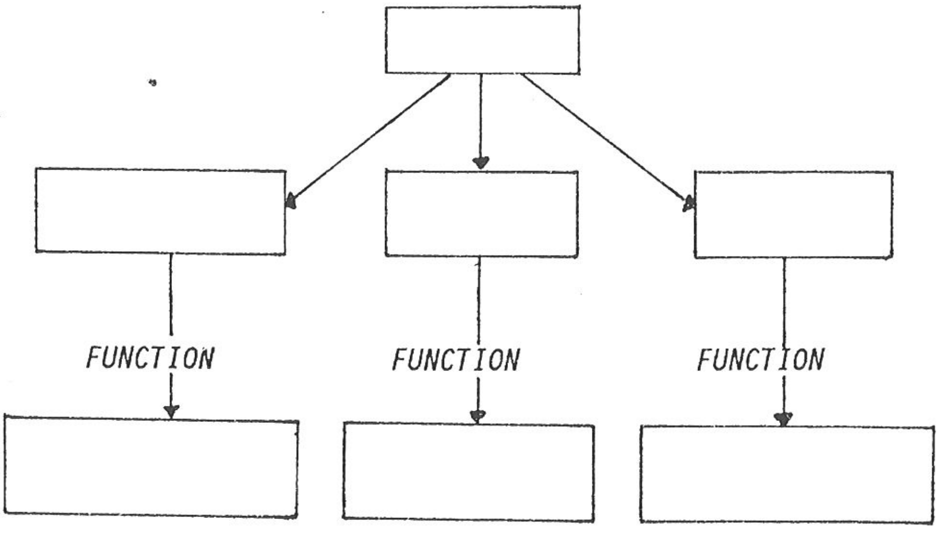
ex: The transistor is the device that *is responsible for* amplifying electric signals.

ex: In communications equipment, coaxial cables and telephone lines *serve to* carry the data.

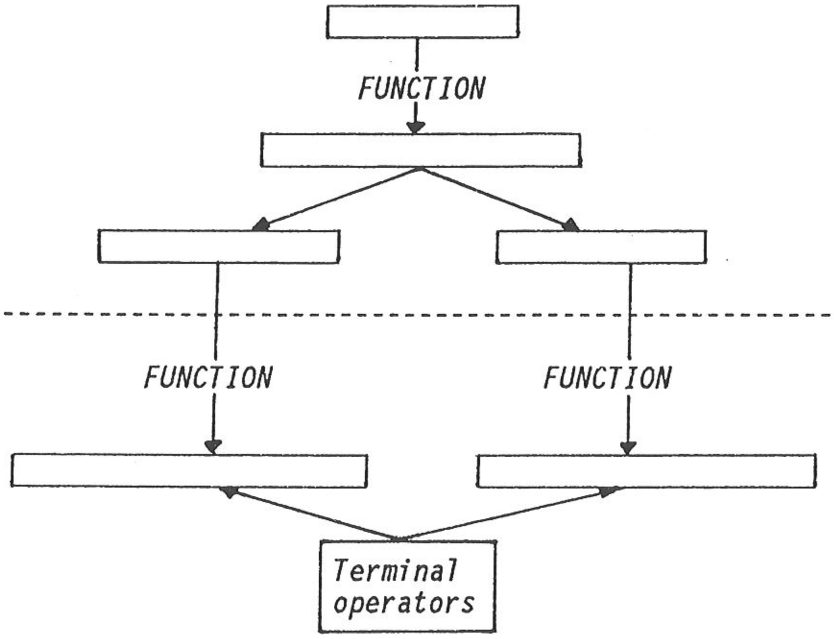
EXERCISES:

1.- Read the following paragraphs and identify the whole, its parts and their functions. Use the diagrams.

a) *An integrated circuit (IC) is a device composed of interconnected transistors, resistors and capacitors. These elements are all formed on a base or substrate of specially prepared semiconductor material. A transistor is a device used for amplifying electric signals. A resistor, on the other hand, serves to impede, or slow, the flow of current. A capacitor performs the function of storing charges.*

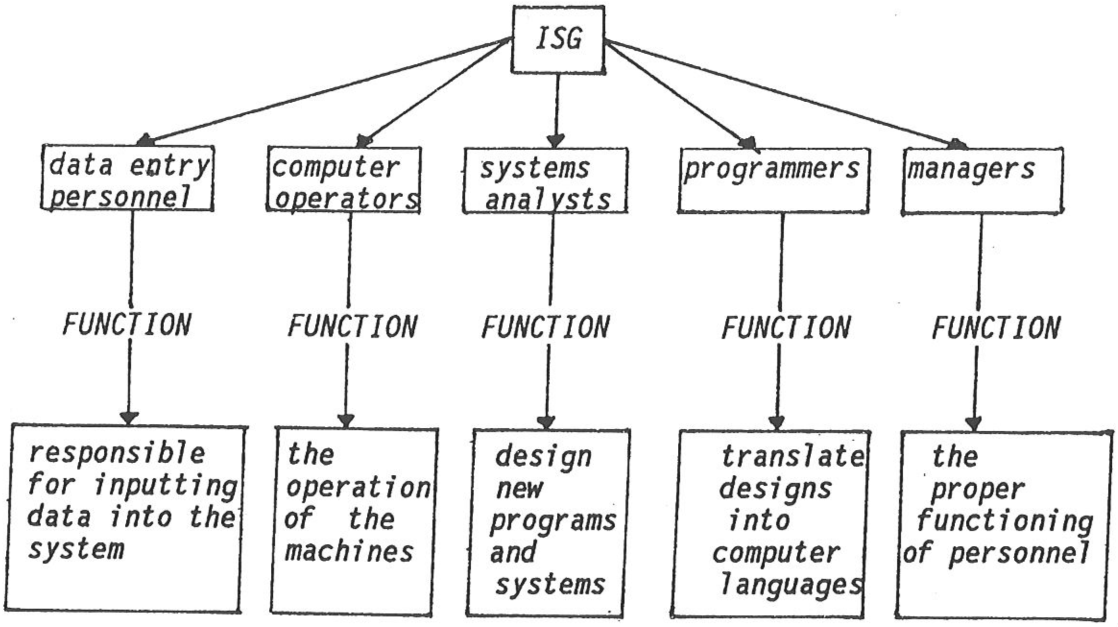


b) A terminal is a device for the input and output of data. It consists of at least two parts: a screen or monitor, and a keyboard. Terminal operators put data into the system with the keyboard. They use the monitor to receive information from the computer.



2.- Now write a paragraph, according to the following diagram, explaining the relation between the whole and the parts. Use the verbs and expressions you have learnt You can start by saying

"The information system group is composed...


ISG
data entry personnel
computer operators
systems analysts
programmers
managers
FUNCTION
FUNCTION
FUNCTION
FUNCTION
FUNCTION
responsible for inputting data into the system
the operation of the machines
design new programs and systems
translate designs into computer languages
the proper functioning of personnel

UNIT 4.

4. CLASSIFICATIONS.

Classification refers to the fact that people or objects can belong to different groups or classes, and that these groups can belong to still larger groups. Actually, the term "classification means to separate objects from one another.

Technical writers use classification in textbooks to divide things into different groups that share common characteristics. Therefore classification is a process of bringing order out of confusion by organizing information in a logical way, usually going from general to specific, or from least important to most important, that is, from specific to general.

4.I TYPES OF CLASSIFICATIONS.

Classification includes two kinds of acts to express a member/class relationship:

1.- *FROM SPECIFIC TO GENERAL: Putting an individual or subclass into a larger class or category.*

The following expressions are used:

*BELONG TO
*BE (MAY BE / COULD BE) CLASSIFIED AS...
*BE CLASSIFIED ACCORDING TO...
*BE PLACED IN THE CLASS X

*is A KIND / TYPE / SORT / VARIETY OF...
*is A MEMBER OF...

EX: A printer *may be classified as* a peripheral device.

2.-*FROM GENERAL TO SPECIFIC: Separating or dividing a class into subclasses or categories.*

The following expressions are useful:

*COMPRISE
*INCLUDE
*BE (MAY BE / COULD BE) DIVIDED INTO...
*BE GROUPED (OR CLASSIFIED) INTO...

*There are several categories / classes / types / aspects of [the class].

EX: *There are four categories of* hardware: input devices, output devices, storage devices and processors.

EXERCISES:

1.- Draw a tree-diagram showing the classification in the text from general to specific.

A DC MOTOR.

An electric motor is a machine for converting electrical energy into mechanical energy. Motors can be designed to run on direct (dc) or alternating current (ac). The motor we are going to describe is a dc motor. Its most important parts are the rotor, the stator and the brushgear.

The rotor is the moving part. It contains an armature, which is a set of wire loops wound on a steel core. When current is fed to the armature, these windings produce a magnetic field. The armature and core are mounted on a shaft which runs on bearings. It provides a means of transmitting power from the motor.

The rotor also contains a commutator. This consists of a number of copper segments insulated from one another. The armature windings are connected to these segments. Carbon brushes are held in contact with the commutator by springs. These brushes allow current to pass to the armature windings. As the rotor turns, the commutator acts as a switch making the current in the armature alternate.

The stator does not move. It consists of magnetic and electrical conductors. The magnetic circuit is made up of the frame and the poles. Wound round the poles are the field coils. These form the electrical circuit of the stator. When current is fed to them, a magnetic field is set up in the stator.

The motor operates on the principle that when a current-carrying conductor is placed in a magnetic field, a force is produced on the conductor. The interaction of the forces produced by the magnetic field of the rotor and the stator makes the rotor spin.

4.II WAYS OF EXPRESSING CLASSIFICATIONS.

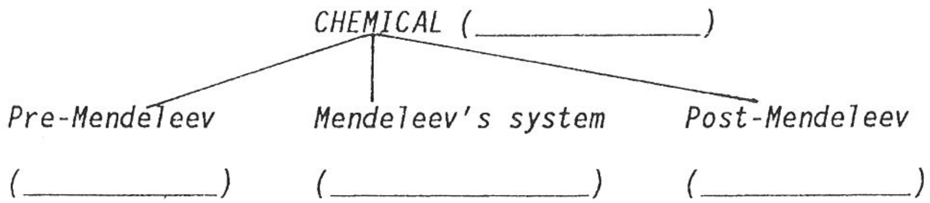
There are some expressions which indicate the criteria the technical writer uses in classifying:

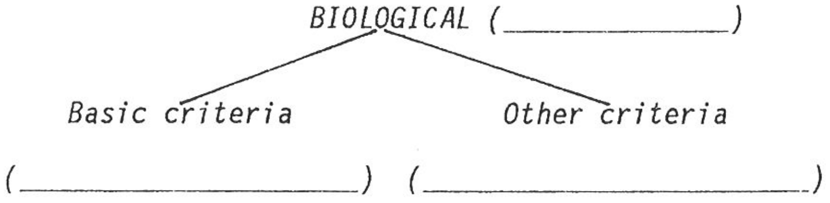
X can be classified	ACCORDING TO WITH RESPECT TO ON THE BASIS OF	*Criteria* ....

Ex: Before Mendeleev, chemical elements were classified *according to* their properties.

EXERCISES.

2) Read the following paragraph and write the criteria used for classification in these diagrams:





Before Mendeleev, chemical elements were classified according to their properties. Mendeleev's contribution was to find a much more exact system of classification, based on atomic weight. More recently, the basis of classification has moved to atomic number. Thus chemical classification has a quantitative basis while biological classification only has a qualitative basis. The basic criteria considered in biological classification are anatomical, ecological and genetical facts relating to each species. Sometimes it is also convenient to group animals with respect to their behaviour --their feeding habits, for example. The point about biological classification is that, unlike a quantitative classification, it gives few grounds for predicting the occurrence of unrecognized species.

Now underline the expressions which indicate that the writer is referring to criteria.

3.III **EXPANDED CLASSIFICATIONS.**

Sometimes a classification can be combined in a text together with *definitions, descriptions* and even *exemplification.*

Some useful expressions to convey the idea of exemplification:

*FOR EXAMPLE / FOR INSTANCE / i.e. / e.g.
*THAT IS / NAMELY
*SUCH AS / LIKE
*AN EXAMPLE OF...

Ex: Many natural materials can be chemically changed into others, *such as* petroleum. *An example of* these changes is that it is used to make plastics.

EXERCISES.

3) Read the text and complete the diagrams after it.

CLASSIFICATION OF PLASTICS.

The behaviour of plastics when heated provides the basis for the distinction between the two main classes of plastics available today. Those like polythene, PVC, perspex and nylon, which soften when heated and become rigid when cooled again, are called thermoplastics; with further heating and cooling these plastics can be made to change their shape repeatedly, for example the gramophone record. This processing is possible because only weak bonding is present between neighbouring molecules, and when warm the molecules slide very easily past one another. On the other hand, plastics which become rigid on further heating and cannot be softened again are called thermosetting plastics. Examples of these are Bakelite and Melamine. These materials consist of polymer chains which react with one another at points of contact so that they become strongly linked together in three dimensions. The intermolecular bonds then prevent from relative movement of the original chains --in fact the material is really one single molecule.